REMARKS

Favorable reconsideration is respectfully requested in view of the foregoing amendments and the following remarks.

I. CLAIM STATUS AND AMENDMENTS

Claims 1-9 were pending in this application when last examined and stand rejected.

Claims 2-6 are cancelled without prejudice or disclaimer thereto.

Claims 1 and 9 are amended. Support can be found in the specific examples in the present specification.

No new matter has been added.

II. ANTICIPATION REJECTION

On pages 4-5 of the Office Action, claims 1-9 were rejected under 35 U.S.C. 102(e) as anticipated by Zhou et al. Applicants note that this is actually a 102(a) rejection. Attached herewith is a Declaration (Attachment A) indicating that the other authors of this reference were merely working under the direction and control of the inventors with regard to the invention described and claimed in this application. Thus, this reference is not by another and therefore this rejection is moot.

III. OBVIOUSNESS REJECTION

On pages 6-9 of the Office Action, claims 1-9 were rejected under 35 U.S.C. § 103(a) as obvious over JP 2002-063934 (Published February 28, 2002) in view of either U.S. 4,537,843 (August 1985) or U.S. Pub. 2006/0092597. Applicants respectfully traverse this rejection as applied to the amended claims.

The Present Invention

The present invention relates to a method of producing an ionic liquid, an electric double-layer capacitor, and a lithium secondary battery, wherein the specific anionic components and cationic components are combined as shown in the amended claims.

By employing the combination of specific anionic and cationic components described in the claims, the present invention makes it possible to obtain an ionic liquid having a low melting point of not greater than 100°C, or glassy properties.

The remarkable effects of the present invention are proven by the Examples disclosed in the present specification. More specifically, Tables 3 and 4 in the specification disclose the physicochemical properties of the ionic liquids of the present invention. In the tables, the melting points are shown in the "Tm" column. "Nd" stands for "not detected"; therefore, in the present specification, "Nd" in the "Tm" column indicates that the relevant liquid exhibits glassy properties.

Summary of Cited References

Takeda (JP2002-63934)

Takeda discloses an electrolyte represented by formula (2) below in which a boron compound is dissolved:

$X^+[(CF_3)_mBF_{4-m}]^-$ ...(2)

wherein X^+ represents an alkali metal ion or onium ion, and m is 1 or 2. Please see Claim 2 of Takeda.

However, Takeda merely discloses the combination of triethylmethylammonium and $CF_3BF_3^-$ as an ammonium ion and boron fluoride-based anion combination in Table 1 (Electrolyte liquid No. 2), and is completely silent about the combinations specified in Claim 1 of the present invention, such as the combination of methyldiethylbutylammonium and $CF_3BF_3^-$, or the combination of methyldiethylbutylammonium and $C_2F_5BF_3^-$.

Shishikura (US 4,537,843)

Shishikura is a US patent disclosing a secondary battery that is made of a polymeric compound having conjugated double bonds. The secondary battery uses, as an electrolyte, an ammonium salt represented by the following formula:

$[NR^1R^2R^3R^4]^+X^-$

wherein R^1, R^2, R^3 and R^4 stand for alkyl groups having 1 to 16 carbon atoms or aryl groups having 6 to 15 carbon atoms, excluding the case where R^1, R^2, R^3 and R^4 are all the same groups. X is an anion (See Claim 1 of Shishikura).

However, Shishikura merely discloses in Tables 1 and 2 the combination of triethylbutylammonium and BF_4^- and the combination of tributylmethylammonium and BF_4^- as ammonium ion and boron fluoride-based anion combinations.

Pub '597 (US2006/0092597)

Pub '597 discloses an electrolyte for an electrolytic capacitor comprising a tetrafluoroaluminate ion, wherein the tetrafluoroaluminate ion is contained in the form of at least one salt selected from the group consisting of quaternary onium salts, amine salts, ammonium salts and alkali metal salts of tetrafluoroaluminate (see Claim 2 of Pub '597).

Pub '597 also discloses, in paragraph [0021] of the specification, examples of quaternary onium ions, such as triethyl-n-butylammonium, and triethyl-t-butylammonium.

However, Pub '597 only discloses BF_4^- as the anion in [0033] and fails to disclose $[BF_3(C_nF_{2n+1})]^-$.

Furthermore, Pub '597 does not specifically disclose combinations of triethyl-n-butylammonium or triethyl-t-butylammonium with a boron fluoride-based anion.

Unobviousness of the present invention

(1) The claimed invention is characterized in that it employs combinations of the aforementioned specific anions and cations.

In contrast, none of the cited references disclose combinations of specific anions and cations such as methyldiethylbutylammonium and $C_2F_5BF_3^-$. Furthermore, none of the cited references disclose methyldiethylbutylammonium.

Accordingly, even a skilled artisan would not arrive at the present invention in which combinations of the claimed specific anions and cations are employed.

(2) Due to the features described above, the present invention makes it possible to obtain an ionic liquid having a low melting point of not greater than 100°C, or glassy properties.

Unlike the present invention, when a combination of an ammonium ion and a boron fluoride-based anion such as that disclosed in the cited references is used, only a solid having a melting point greatly exceeding 100°C can be obtained.

As shown in Table 6 of the present specification, when triethylmethylammonium is combined with $CF_3BF_3^-$, the melting point reaches as high as 181°C. Furthermore, the melting point of the salt formed by the combination of triethylbutylammonium with BF_4^-, is 163°C,

which is also much higher than 100°C. Enclosed herewith is a signed declaration indicating these facts (Attachment B).

The melting point of the salt formed by the combination of tributylmethylammonium with BF_4^- is 165°C, which is also much higher than 100°C. For reference, we enclose a copy of "Heinz Kobler, Rudolf Munz, Gasser Al Gasser, Gerhard Simchen Justus Liebig Annalen der Chemie, 1978, Vol. 12, pp. 1,937-1,945" as Attachment C. Attachment C discloses the melting points on page 1,944, line 10 from the bottom.

It is very difficult to predict the melting point and other physicochemical properties of an ion pair from the structure of the ion pair. The melting point cannot be calculated even by a supercomputer. Therefore, the properties of the claimed invention would not be conceived by a person skilled in the art as they are unpredictable.

Thus, for the above-noted reasons, this rejection is untenable and should be withdrawn.

CONCLUSION

In view of the foregoing amendments and remarks, it is respectfully submitted that the present application is in condition for allowance and early notice to that effect is hereby requested.

If the Examiner has any comments or proposals for expediting prosecution, please contact the undersigned attorney at the telephone number below.

Respectfully submitted,

Hajime MATSUMOTO et al.

/William R. Schmidt, II/
2010.06.07 13:32:19 -04'00'

By _____
William R. Schmidt, II
Registration No. 58,327
Attorney for Applicants

WRS/vah
Washington, D.C. 20005-1503
Telephone (202) 721-8200
Facsimile (202) 721-8250
June 7, 2010